expect. Experiment is the only possible test, and the date of the crucial trial is still far distant.

This, however, does not prevent the author from indulging in an interesting speculation:

> Suppose that this new protoplasm had properties slightly different from those types which we know; its accidental discovery might involve us in very serious consequences. Assume that it had great powers of assimilation and reproduction, and we might find it rather a dangerous neighbor, so that finally the new discovery might end in the rapid extirpation of the long-sought-for product. Even more serious, however, would be the state of things if the synthetic creature resembled our ordinary bacteria, and was capable of lodging in animals, and there liberating new forms of toxins against which we are not immunized. It is just a possibility, but it would certainly be a most awkward end to an experiment.

The further career of this future Frankenstein may be left to the speculations of H. G. Wells.

The essays on chemical research may well be commended to every one interested in the future of those industries which are in any way connected with the applications of chemistry. While written from an English standpoint, they are none the less applicable in America. In both these countries the future held out to the student of chemistry is by no means attractive and the expectation of adequate remuneration for a life work is less than in many other fields. Yet the future of these industries is bound up with chemical research, and that not merely in the field of the direct applications of chemistry, but even more especially in the field of pure science, and here it is that there is the least hope of adequate remuneration. The outlook is nevertheless not without hope, both in Britain and in America. The foundation of the Carnegie Trust for the Universities of Scotland and the Science Research Scholarships of the Royal Commission for the International Exhibition of 1851 are dwelt on at length, as steps in the right direction, and in an appendix is set forth the Outline of a Scheme for the Improvement of Research Conditions, worthy careful perusal, however much one may disagree with some of the suggestions.

The book is well written and comparatively free from errors, though exception might be taken to the accuracy of occasional statements. We object seriously to the use, unfortunately far too frequent here and elsewhere, of "body" where "substance" or "compound" is meant, and we wonder if the word "researcher," for one engaged in research, has come to stay.

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Nucleic Acids. Their Chemical Properties and Physiological Conduct. By Walter Jones, Ph.D. Longmans, Green & Co. 1914. Pp. viii + 118.

Nucleic acids and their components have held, for more than a century, the interest of the chemist, of the biologist, of the physician, of the pharmacologist, and of the physiologist.

The first acquaintance with the derivatives of nucleic acid was made through the discovery of uric acid by Scheele in the year 1776. The name given to the substance betrays the scanty information of the discoverer concerning the chemical structure of the acid, hence of its exact place in the economy of the organism. The constant occurrence in the urine of appreciable quantities of uric acid may have led one to the conclusion that it belonged to the class of final products of metabolism. What was the mother substance of uric acid? The question could not be answered when information concerning the chemistry of the tissue components, or of food stuffs, was lacking.

Nucleic acids were discovered much later by Altman, a cell biologist. He was in search for an explanation of the staining properties of cell nuclei. The problem, as far as Altman was concerned, was solved by the demonstration of the presence in the cell nuclei of a substance with the properties of an acid. The substance was named nucleic acid. Altman little thought of the possible relationship of the new substance to the uric acid of the urine. On the other hand, the chemists and physicians engaged in researches on uric acid

suspected as little a relationship between the two acids. It required years of labor to bring the two independent lines of inquiry to a common ground and to a mutual understanding.

The inquiry into the chemical structure of uric acid led up to the classical work of Fischer on the "purin" derivatives. This work established the relationship of uric acid to xanthin, hypoxanthin, guanin and adenin—basic substances discovered in the extracts of animal tissues. It then became evident that the uric acid of the urine is a product of animal combustion of purin bases.

On the other hand, the inquiry into the structure of nucleic acids led up to the knowledge that these acids contain in their molecule purin bases. Thus, by some display of imagination, the origin of the purin bases of tissue extracts could be explained by a rupture of the complex structure of the nucleic acid molecule. The genesis and the fate of uric acid became obvious. This triumph of knowledge is unquestionably important for its own sake. However, in this place it may be of service as an illustration of the scope of biological chemistry as compared with that of the structural organic chemistry.

The discovery of the arrangement of atoms in a given molecule is the aim of the structural chemist. The physical and chemical properties of a molecule are determined by the arrangement of the component atoms. The work of the chemist is completed when he is successful in arranging hypothetically all the atoms of the molecule in such a manner that the conduct of the molecule appears a natural sequence of this arrangement.

Not so simple is the task of a biological chemist. A tissue component is not only a chemical, but also a biological unit. It is not only a reacting body but also a structural element of cells and tissues. Furthermore, it reacts not only in its state of integrity, but also in its state of dissociation. The dissociation is most generally a complex process, and is controlled by well regulated mechanisms. In a word, the scope of biological chemistry is not only the chemical structure of substance, but the life cycle of the structure, and the relation of this cycle to that of the other tissue elements.

Hence, the biochemical problems are very complex, and for the present it is difficult to point out any tissue component regarding which our knowledge is complete.

The subject of nucleic acid is one of the most successful chapters in the history of biochemical inquiry. Not that information is complete either in regard to the structure or in regard to the conduct of this group of substances. But the information that is lacking is small as compared with that already acquired. And the information acquired concerns equally the biologist, the chemist and the physician.

To sum up all the recent progress in this field of research is a very difficult undertaking. Professor W. Jones in his monograph on "Nucleic Acids" has acquitted himself of the task in a most masterly manner. The work contains a very systematic and keen analysis of all the numerous publications in this field of biochemical research. And yet, the book reflects the personality of the author and his interests as an investigator. Dr. Jones has contributed considerably to the knowledge of the chemical structure of nucleic acids, but his most important contributions relate to the process of their disintegration in the organism. Naturally the chapters on the "conduct" of the nucleic acids carry most inspiration. Hence, the biologist, the physician, and the physiologist will read the book with special interest. However, also the chemist will find a complete and very comprehensive review of all the work dealing with the chemical structure of nucleic acids.

The first part of the monograph deals with nucleins, nucleoproteins, and with "nucleic acids" in general. The second chapter of this part gives a good account of the chemistry of nucleic acids of animal origin, and the concluding chapter reviews the results of the recent work on the nucleic acids of plant origin.

The second part gives a critical résumé of the very extensive literature dealing with the questions of biological formation of nucleic

acids, and of the process of their disintegration. Reading these chapters, one can not help being impressed by the complexity of the mechanism which controls the catabolism of nucleic acids. There have been described in the animal organism at least a dozen agents (enzymes) taking part in the work of the destruction of nucleic acids. Undoubtedly more will be discovered. Each of the known enzymes is capable of inducing only one reaction, of performing only one phase in the general process.

The reading of these chapters is instructive, not only for the information contained in them, but as an illustration of the means employed by the animal organism in order to bring about a very gradual transformation of the complex tissue components into simpler derivatives. How great must be the number of enzymes residing in animal tissues if more than a dozen are required for the catabolism of only one tissue component!

P. A. Levene

STANDARDIZATION OF COURSES AND GRADES

The following regulations were adopted for the guidance of the faculty at a recent meeting of the president's council of the George Washington University:

To the President's Council: The Committee on Standardizing Grades appointed last June begs leave to submit suggestions upon the following two problems:

1. How can the amount of work required for each unit of credit be approximately equalized in the various courses?

2. What common standard of grading can the various members of the faculty observe so that they will all grade approximately on the same standard?

In submitting principles and standards for the solution of these problems the committee wishes first of all to be understood that it does not wish to dictate, or even to suggest, how any member of the faculty should do his work. It not only has no intention of curtailing the legitimate rights and freedom of any teacher, but it desires especially to emphasize that these rights and freedom are sacred; that they are an indispensable condition for the best type of university work.

But in schools, colleges and universities the personal side is not the only side to teaching. There is present also a social side which grows out of the fact that a school is in some fundamental aspects a social unit. The various members of the faculty are all working to contribute in piecemeal to the same end. They are all contributing to the rounded education of individuals, and to the extent that social relationships are involved in this process to that extent is it necessary to observe similar standards and principles. When this is not done the equilibrium and the efficient working of the whole is disturbed. Students in considerable number will elect those courses in which they can get the largest number of credits or the highest grades, or both, for the least work, and they will shun those courses in which the opposite is true.

But in observing similar standards and principles in those matters that pertain to the school, as a whole, it would seem that no desirable aspect of the personal freedom of the teacher needs to be violated. A common goal only needs to be recognized, the manner of reaching the goal being left to the individual teacher. We have here an example of the type of liberty within law that obtains elsewhere in society.

Equalization of Units

It appears to be true that the amount of work required of students in different courses carrying equal amounts of credit varies greatly. While in some courses little more than attendance upon lectures and the passing of examinations is required, in others from one to three or even four hours of outside preparation for each lesson is required in addition. To minimize this divergence the committee recommends:

(*a*) That all teachers strive to require about two hours of outside preparation for each lesson.

(*b*) That courses which are now so weighted that they can not be completed with this amount of study be readjusted so that they can ordinarily be completed with two hours of preparation for each lesson.

(*c*) That lecture courses in connection with which it is impossible or undesirable to assign any considerable amount of outside work carry one half as many credits as the number of lectures per week.

Distribution of Grades

Considered from the social standpoint, the college, in common with other schools, performs two interrelated, although distinguishable fundamental functions. It (1) educates and it (2) selects.